Claims

[c1] 1. An integrated radio-frequency receiver, comprising:

a local oscillator, to generate a local oscillation signal;

a mixer apparatus, coupled to the local oscillator to receive a radio-frequency carrier input signal and the local oscillation signal, and to mix, filter and amplify the radio-frequency carrier input signal and the local oscillation signal to output a first amplified signal and a second amplified signal;

a phase-shift apparatus, coupled to the mixer apparatus to shift phases of the first and second amplified signals with a first degree and a second degree, and to output a first phase-shifted signal and a second phase-shifted signal; and

an analog-to-digital conversion apparatus, coupled to the mixer apparatus and the phase-shift apparatus to receive the first amplified signal and the second phase-shifted signal, and the second amplified signal and the first phase-shifted signal, so as to output an in-phase signal and an orthogonal-phase signal by performing analog-to-digital conversion thereon, respectively.

[c2] 2. The integrated radio-frequency receiver according to claim 1, wherein the phase-shift apparatus comprises:

a first phase shifter, coupled to the mixer apparatus and the analog-to-digital conversion apparatus to receive the first amplified signal, and to shift the first amplified signal with the first degree to output the first phase-shifted signal; and

a second phase shifter, coupled to the mixer apparatus and the analog-to-digital conversion apparatus to receive the second amplified signal, and to shift the second amplified signal with the second degree to output the second phase-shifted signal.

[c3] 3. The integrated radio-frequency receiver according to claim 2, wherein the first degree is 90^{o}.

[c4] 4. The integrated radio-frequency receiver according to claim 2, wherein the second degree is 90^{o}.

[c5] 5. The integrated radio-frequency receiver according to claim 2, wherein the first phase shifter is operative to reduce an intermediate frequency.

[c6] 6. The integrated radio-frequency receiver according to claim 2, wherein the second phase shifter is operative to reduce an intermediate frequency.

[c7] 7. The integrated radio-frequency receiver according to claim 2, wherein the first phase shifter is implemented by a switching capacitor circuit.

[c8] 8. The integrated radio-frequency receiver according to claim 2, wherein the second phase shifter is implemented by a switching capacitor circuit.

[c9] 9. The integrated radio-frequency receiver according to claim 1, wherein the mixer apparatus comprises:

a 90^{o} phase shifter, coupled to the local oscillator to receive the local oscillation signal and to shift the local oscillation signal by 90^{o}, and to output a 90^{o} shifted local oscillation signal;

a first mixer, coupled to the local oscillator to receive and mix the radio-frequency carrier input signal and the local oscillation signal, so as to output a first intermediate-frequency signal;

a second mixer, coupled to the 90^{o} phase shifter to receive and mix the local radio-frequency carrier input signal and the 90^{o} shifted local oscillation signal, so as to output a second intermediate-frequency signal;

a first filter, coupled to the first mixer to receive the first intermediate-frequency signal and to filter the first intermediate-frequency signal to output a first base-band signal;

a second filter, coupled to the second mixer to receive the second intermediate-frequency signal and to filter the second intermediate-frequency signal to output a second base-band signal;

a first amplifier, coupled to the first filter to receive and amplify the first base-band signal and output a first amplified signal; and

a second amplifier, coupled to the second filter to receive and amplify the second base-band signal and output a second amplified signal.

[c10] 10. The integrated radio-frequency receiver according to claim 9, wherein the first filter includes a low-pass filter.

[c11] 11. The integrated radio-frequency receiver according to claim 9, wherein the

second filter includes a low-pass filter.

[c12] 12. The integrated radio-frequency receiver according to claim 1, wherein the analog-to-digital conversion apparatus comprises:
a first sample maintaining apparatus, coupled to the mixer apparatus and the phase-shift apparatus to receive the first amplified signal and the second phase-shifted signal, and to perform arithmetic operation and sample maintaining thereon to output a first sample maintaining signal;
a second sample maintaining apparatus, coupled to the mixer apparatus and the phase-shift apparatus to receive the second amplified signal and the first phase-shifted signal, and to perform arithmetic operation and sample maintaining thereon to output a second sample maintaining signal;
a first analog-to-digital converter, coupled to the first sample maintaining apparatus to receive the first sample maintaining signal, and to perform analog-to-digital conversion thereon to output the in-phase signal; and
a second analog-to-digital converter, coupled to the second sample maintaining apparatus to receive the second sample maintaining signal, and to perform analog-to-digital conversion thereon to output the orthogonal-phase signal.

[c13] 13. The integrated radio-frequency receiver according to claim 1, including a single-side-band receiver.

[c14] 14. An integrated radio-frequency receiver, comprising:
a local oscillator, to generate a local oscillation signal;
a 90^{o} phase shifter, coupled to the local oscillator to receive the local oscillation signal and to shift the phase of the local oscillation signal by 90^{o} into a 90^{o} shifted local oscillation signal to be output;
a first mixer, coupled to the local oscillator to receive and mix a radio-frequency carrier input signal and the local oscillation signal to output a first intermediate-frequency signal;
a second mixer, coupled to the 90^{o} phase shifter to receive and mix the radio-frequency carrier input signal and the 90^{o} shifted local oscillation signal to output a second intermediate-frequency signal;

a first filter, coupled to the first mixer to receive and filter the first intermediate-frequency signal to output a first base-band signal;
a second filter, coupled to the second mixer to receive and filter the second intermediate-frequency signal to output a second base-band signal;
a first amplifier, coupled to the first filter to receive and amplify the first base-band signal and output a first amplified signal;
a second amplifier, coupled to the second filter to receive and amplify the second base-band signal and output a second amplified signal;
a first phase shifter, coupled to the first amplifier to receive and shift the phase of the first amplified signal with a first degree, so as to output a first phase-shifted signal;
a second phase shifter, coupled to the second amplifier to receive and shift the phase of the second amplified signal with a second degree, so as to output a second phase-shifted signal;
a first sample maintaining apparatus, coupled to the first amplifier apparatus and the second phase shifter to receive the first amplified signal and the second phase-shifted signal, and to perform arithmetic operation and sample maintaining thereon to output a first sample maintaining signal;
a second sample maintaining apparatus, coupled to the second amplifier and the first phase shifter to receive the second amplified signal and the first phase-shifted signal, and to perform arithmetic operation and sample maintaining thereon to output a second sample maintaining signal;
a first analog-to-digital converter, coupled to the first sample maintaining apparatus to receive the first sample maintaining signal, and to perform analog-to-digital conversion thereon to output the in-phase signal; and
a second analog-to-digital converter, coupled to the second sample maintaining apparatus to receive the second sample maintaining signal, and to perform analog-to-digital conversion thereon to output the orthogonal-phase signal.

[c15] 15. The integrated radio-frequency receiver according to claim 14, wherein the first degree is 90^{o}.

[c16] 16. The integrated radio-frequency receiver according to claim 14, wherein the

second degree is 90^{o}.

[c17] 17. The integrated radio-frequency receiver according to claim 14, wherein the first phase shifter is operative to reduce the frequency of an intermediate frequency.

[c18] 18. The integrated radio-frequency receiver according to claim 14, wherein the second phase shifter is operative to reduce the frequency of an intermediate frequency.

[c19] 19. The integrated radio-frequency receiver according to claim 14, wherein the first phase shifter is implemented by a switching capacitor circuit.

[c20] 20. The integrated radio-frequency receiver according to claim 14, wherein the second phase shifter is implemented by a switching capacitor circuit.

[c21] 21. The integrated radio-frequency receiver according to claim 14, wherein the first filter includes a low-pass filter.

[c22] 22. The integrated radio-frequency receiver according to claim 14, wherein the second filter includes a low-pass filter.

[c23] 23. The integrated radio-frequency receiver according to claim 14, including a single-side-band receiver.